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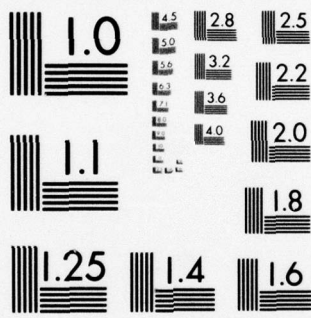
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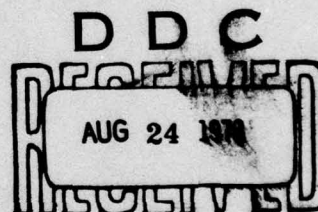
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SUMMARY LISTING OF
SYSTEM EFFECTIVENESS TASKS

Conducted for
NAVAL OCEAN SYSTEMS CENTER
San Diego, California
Under Contract N00123-73-C-1698

May 1978



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ABSTRACT

System effectiveness tasks on Ocean Technology projects provided the Naval Ocean Systems Center by ARINC Research Corporation under Contract N00123-73-C-1698 are summarized. Task areas, activities, and delivered items are briefly identified for 33 tasks conducted during the period 23 May 1973 through 31 January 1978.

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SUMMARY

This report summarizes system effectiveness studies and other technical support provided by ARINC Research Corporation for Ocean Technology projects of the Naval Ocean Systems Center (NOSC), San Diego, California. The work was performed under Contract N00123-73-C-1698 during the period 23 May 1973 through 31 January 1978.

During the contract period, ARINC Research completed 33 task assignments involving the application of effectiveness engineering techniques in the areas of reliability, maintainability, integrated logistic support, safety, quality assurance, and design engineering. These techniques were applied to a variety of Ocean Technology and marine systems projects. Upon completion of each assignment a report was submitted to NOSC detailing the work accomplished and, where applicable, presenting conclusions and recommendations.

This report briefly identifies the work accomplished on each task assignment.

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INTRODUCTION

This report summarizes work performed by ARINC Research Corporation for the Naval Ocean Systems Center (NOSC) under Contract N00123-73-C-1698. The work was accomplished during the period 23 May 1973 through 31 January 1978 and under the technical direction of various NOSC technical codes.

The overall objective of the subject contract is stated (in its part II, item E-1) as: "...conduct reliability, maintainability, design and quality assurance studies on various Navy Ocean Technology projects." A detailed listing of contract tasks appears in Appendix A of this report. Results of the tasks are briefly described in the following section, with reference made to documentation (previously submitted to NOSC by ARINC Research) containing greater detail.

2 SUMMARY OF WORK BY TASK

The work performed under Contract N00123-73-C-1698 is summarized below in order of task assignment.

2.1 TASK 01: CONDUCT PARTIAL STRUCTURAL ANALYSIS OF MINE NEUTRALIZATION VEHICLE (MNV)

2.1.1 Activities

- Analyzed the mechanical/structural integrity of the vehicle.
- Assisted in the establishment of design requirements.
- Assessed the impact of engineering changes on vehicle reliability.
- Analyzed the structural integrity of vehicle lifting devices.

2.1.2 Submittals

- Publication W3-1616-TN01, "Partial Structural Analysis, Mine Neutralization Vehicle", July 1973

2.2 TASK 02: CONDUCT RELIABILITY ANALYSIS OF REMOTE UNMANNED WORK SYSTEM (RUWS)

2.2.1 Activities

- Developed mission scenarios and determined all equipments used for each mission phase.
- Determined the operating time of equipments used for each mission phase.
- Calculated system reliability for each mission phase.
- Calculated cumulative reliability as a function of mission phase.
- Identified the systems and subsystems having low reliability.
- Determined the effect of increasing subsystem or equipment MTBF.
- Recommended system, subsystem and equipment changes to improve reliability.

2.2.2 Submittals

- Publication 1616-02-1-1265, "Reliability Improvement Study, Remote Unmanned Work System", November 1973
- Final Letter Report SNA/CA-73-308, 1 November 1973
- Six biweekly technical progress letter reports

2.3 TASK 03: CONDUCT RELIABILITY STUDY OF SHIPS TOWED ACOUSTIC DECEPTION DEVICE (STADD) SYSTEM

2.3.1 Activities

- Conducted a study to determine STADD hardware reliability requirements.
- Developed an outline specification for the STADD Ship Synthesizer.
- Developed equipment functional requirements and design guidelines.
- Assisted in finalization of the Type B-1 Prime Item Development Specification.

2.3.2 Submittals

- STADD Specification Outline, 31 July 1973 (informal submission)
- STADD Specification Section 3.0, "Requirements" (three informal submissions on 7 August, 6 September, and 25 September 1973)
- Final Letter Report, 30 October 1973

2.4 TASK 04: (Deleted)

2.5 TASK 05: CONDUCT MECHANICAL/STRUCTURAL RELIABILITY ANALYSIS OF WORK SYSTEM PACKAGE (WSP)

2.5.1 Activities

- Analyzed the preliminary WSP structure and established design criteria.
- Conducted a design evaluation of the WSP based on anticipated environment, including a detailed stress analysis of the WSP structure.
- Performed a structural design evaluation of the TURTLE submersible with attached WSP.
- Conducted a design study to determine interface requirements for the AUTEC submersible/WSP battery pack.

2.5.2 Submittals/Letter Report 1616-05

- Letter Report 1616-05, "WSP Design Criteria Analysis, Discussion and Work Sheets", 24 September 1973
- Publication W3-1616-TN02, "Design Evaluation of WSP", November 1973
- Letter Report, "Structural Design Evaluation of TURTLE/WSP Assembly and Lifting Gear", 26 December 1973
- Letter Report SDSO-74-348, "Work System Package Auxiliary Battery Pack Design Study", 11 July 1974

2.6 TASK 06: (Deleted)

2.7 TASK 07: CONDUCT TECHNICAL REVIEW OF PROCUREMENT SPECIFICATION FOR WORK SYSTEM PACKAGE (WSP) MULTIPLEX SYSTEM

2.7.1 Activities

- Reviewed the WSP Multiplex System Specification for technical adequacy.
- Reworked specification Section 4 per the requirements of MIL-STD-490.

2.7.2 Submittals

- Specification rework draft (informal submission), 18 September 1973
- Final Letter Report, 30 October 1973

2.8 TASK 08: CONDUCT RELIABILITY AND MAINTAINABILITY STUDIES ON MK 116 UNDERWATER FIRE CONTROL SYSTEM (UFCS)

2.8.1 Activities

- Reviewed reliability, maintainability, and availability (RM&A) documentation developed by the Mk 116 UFCS hardware contractor to determine fulfillment of concept formulation RM&A objectives.
- Developed an integrated equipment-level reliability and maintainability demonstration test plan.
- Developed detailed reliability and maintainability demonstration test procedures.
- Monitored and documented the reliability and maintainability tests.
- Developed a final formal reliability and maintainability demonstration test report.

2.8.2 Submittals

- Letter Report, "Maintainability Demonstration Test Plan for the Weapon Control and Setting Subsystem of the Mk 116 Mod 1 UFCS", 12 August 1974
- Five biweekly test progress reports, ARINC Research letters:
 - SDSO-74-117, 22 May 1974
 - SDSO-74-222, 4 June 1974
 - SDSO-74-330, 17 June 1974
 - SDSO-74-347, 1 July 1974
 - SDSO-74-353, 15 July 1974
- Publication 1616-08-2-1328, "Reliability and Maintainability Demonstration Testing of Weapon Control and Setting Subsystem of Underwater Fire Control System Mk 116 Mod 1", October 1974
- Final Letter Report CA/W-74-279, 14 October 1974

2.9 TASK 09: PERFORM ANALYSIS OF INTERFACE REQUIREMENTS FOR LOGISTICS DATA SYSTEM

2.9.1 Activities

- Investigated the LO-MIX Logistics Data System.
- Examined standard maintenance engineering analysis (MEA) practices.
- Determined LO-MIX maintenance engineering analysis (LMMEA) requirements.
- Developed LMMEA techniques and documentation requirements.
- Tested the LMMEA techniques.
- Developed and published a preliminary and final LMMEA report.

2.9.2 Submittals

- Letter Report CA/E-74-748, "LO-MIX Maintenance Engineering Analysis Technique" (Preliminary Report), 19 November 1974
- Letter Report CA/E-75-1, "LO-MIX Maintenance Analysis Technique" (Final Report), 2 January 1975
- Letter Report CA/E-75-75, "LO-MIX Maintenance Engineering Analysis (LMMEA) Instructions and Forms", 3 February 1975

2.10 TASK 10: PROVIDE RELIABILITY AND MAINTAINABILITY (R&M) ENGINEERING SUPPORT ON MOBILE SUBMARINE SIMULATOR (MOSS) PROGRAM

2.10.1 Activities

- Reviewed and assessed the MOSS hardware contractor's reliability and maintainability programs.
- Analyzed the maintainability and maintenance documentation techniques used for MOSS and provided recommendations for improvement.
- Developed logistic support requirements for Fleet introduction and in-service support of MOSS.
- Performed an R&M assessment of MOSS during Technical Evaluation (TECHEVAL).
- Developed technical data for inclusion in the MOSS Technical Manual (OP4336), including the following specific items:
 - Equipment descriptions
 - Packaging procedures
 - Handling procedures
 - Maintenance procedures
- Conducted an analysis of MOSS probability of success.

2.10.2 Submittals

- Letter Report SDSO-74-448, "MOSS Program R&M Assessment", 27 September 1974
- Letter Report SDSO-75-52, 25 February 1975, which transmitted the following documents:
 - "Program Planning Guidance as Established by NAVSEA 660, NAVSEA 06H, OPNAV and CNO Personnel"
 - "Logistic Planning Data and Cost Estimates to Support TRIDENT, SSBN, SSN 594 and 637 Class Submarines"
 - "Cost Estimates to Support TRIDENT Class Submarines"
 - "Logistic Planning Data and Cost Estimates to Support TRIDENT, SSBN, SSN 594, 637, and 688 Class Submarines"
 - "Program Personnel Data Sources"

- Letter Report FSP-75-13, "Probability of Success Computations, Comments Concerning", 1 May 1975
- Publication 1616-10-5-1417, "Reliability and Maintainability Assessment of Mobile Submarine Simulator from TECHEVAL Data", July 1975
- Letter Report FSP-75-97, "MOSS System Technical Manual Inputs", 2 July 1975

2.11 TASK 11: SYSTEM VALIDATION MODEL — TARGET DATA PROCESSOR/COMMUNICATION PROCESSOR (SVM-TDP/CP) QUALITY ASSURANCE, TEST AND INTEGRATION PLANNING SUPPORT

2.11.1 Activities

- Developed quality assurance provisions for TDP/CP computer program performance specifications.
- Prepared a TDP/CP Master Test Program Plan.
- Investigated the diagnostic/fault-isolation capability required for the TDP/CP.
- Assisted in the development of the SVM Integration Test Plan.

2.11.2 Submittals

- The following Computer Program Performance Specification (CPPS) Quality Assurance sections were prepared and submitted:
 - a. EXEC — AN/UYK-7 (SHARE 7 MODS)
 - b. DBM — AN/UYK-7
 - c. EXEC — AN/UYK-20 (CPOS)
 - d. DBM — AN/UYK-20 (CPOS)
 - e. L&T and CORR/CLASS (L&T CORR)
 - f. Resource Allocation Program
 - g. COMM Processor (C/P NAVFAC)
 - h. Interactive Display (EC Display)
 - i. EC MIP/MOP
 - j. Operation utility routines.
- "Quality Assurance Monitoring Plan", 13 March 1975 (informal submission)
- "TDP/CP Master Test Program Plan" (submitted in draft form in December 1974, and in final form in February 1975)

- Publication 1616-11-6-1440, "Quality Assurance Support for System Validation Model — Target Data Processor/Communication Processor (SVM TDP/CP) Program", August 1975

2.12 TASK 12: LO-MIX MAINTENANCE ENGINEERING ANALYSIS (LMMEA) PILOT PROGRAM

2.12.1 Activities

- Accomplished the initial implementation of the LO-MIX Maintenance Engineering Analysis (LMMEA) Program. This effort consisted of using LMMEA procedures to group the equipments in the Patrol Frigate (PF) and Patrol Hydrofoil Missile (PHM) ship systems; completion of approximately 15 Class II LMMEAs on a pilot basis; revision of the Data Analysis Sheet (DAS); and revision of the DAS preparation instruction.
- Investigated and analyzed the maintenance Data System (MDS) developed by NAVSEA PMS 306, and developed the logistic data element input requirements for that system. Determined the logistic data input method most compatible with the developing PMS 306 MDS and the previously developed LMMEA technique.
- Developed a method of integrating the LMMEA technique results with the PMS 306 MDS; redesigned the DAS previously developed to conform to the requirements of the PMS 306 MDS; and provided the vehicle for input of LMMEA results to the MDS.
- Developed a detailed instruction for recording LMMEA results on the redesigned DAS.

2.12.2 Submittals

- Letter CA/E 75-411, "Completed LMMEAs", 30 June 1975
- Letter CA/E 75-413, "Summary Report — LO-MIX Maintenance Engineering Analysis (LMMEA) Pilot Effort", 30 June 1975

2.13 TASK 13: SVM TDP/CP COMMUNICATIONS/SCHEDULING SUPPORT

2.13.1 Activities

- Task 13 was initially directed to the preparation of quality assurance documentation for communications software; redirected to the development of an

automated scheduling system; then further redirected to participation as a member of the Design Review Group and to the review of the project documentation.

2.13.2 Submittal

- Publication 1616-11-6-1440, "Quality Assurance Support for System Validation Model — Target Data Processor/Communication Processor (SVM TDP/CP) Program", August 1975

2.14 TASK 14: SVM TDP/CP APPLICATIONS SOFTWARE SUPPORT

2.14.1 Activities

- Prepared plans and procedures to assure the quality of applications software. A Quality Assurance Monitoring Plan was prepared for the computer application programs, and submitted informally.
- Prepared, reviewed, and maintained software quality documentation. Complete revisions of all CPPSs for the application programs were prepared, coordinated, and submitted.
- Assisted in test planning and evaluation. This activity was terminated shortly after it was undertaken, and no deliverable items were produced.
- Performed quality design review. Informal design assistance and review were performed on several applications programs. The main activity was on the Resource Allocation CPPS.

2.14.2 Submittals

- As noted in 2.14.1 above; and
- Publication 1616-11-6-1440, "Quality Assurance Support for System Validation Model — Target Data Processor/Communication Processor (SVM TDP/CP) Program", August 1975

2.15 TASK 15: SVM TDP/CP SYSTEM SOFTWARE SUPPORT

2.15.1 Activities

- Prepared plans and procedures to assure the quality of system software. A Quality Assurance Monitoring Plan was prepared for the system software

and submitted informally. A quality assurance checklist for in-house contractors was developed and submitted on 27 March.

- Prepared, reviewed, and maintained software quality documentation. A complete revision of the DBM Quality Assurance section was prepared.
- Assisted in test planning and evaluation. This task was terminated shortly after it was undertaken.
- Performed quality design review. Informal design reviews were conducted during meetings on the Data Base Manager (DBM) Program.

2.15.2 Submittals

- Monthly letter reports were prepared and submitted covering the software quality activity
- Publication 1616-11-6-1440, "Quality Assurance Support for System Validation Model - Target Data Processor/Communication Processor (SVM TDP/CP) Program", August 1975

2.16 TASK 16: PHM SHIP CLASS ILS SUPPORT

2.16.1 Activities

- Investigated the ILS action status for the PHM Acquisition Project.
- Determined planning and action deficiencies, and the actions required to correct them.
- Reviewed PHM ILS Program Master Plan (PMP) and other planning documents to determine planning and/or plan implementation deficiencies.
- Developed a plan for correction of deficient logistic support elements.
- Provided a schedule for the preparation of Logistic Support Plan (LSP) Summary supporting documents to ensure meeting DSARC III presentation requirements.
- Analyzed the information and documentation flow of all changes approved or requested to the contract providing for the construction of the PHM ship class.
- Identified deficiencies that might preclude or interfere with information transmission.
- Developed an information procedure addressing the status of all change actions for PHM class ships.
- Analyzed the information and material flow necessary to accomplish interim logistic support of PHM-1. Recommended procedural changes deemed necessary to accomplish interim support.
- Identified points of responsibility and authority of both CFE and GFE spare and repair parts.
- Reviewed the relationship between the operational maintenance data collection system developed by the Hydrofoil Special Trials Unit, the Navy 3-M MDCS, and the requirements of PMS-303. Recommended procedural changes to satisfy PMS-303 requirements.
- Prepared the DSARC III maintenance supporting documentation required for the Logistic Support Plan Summary.

- Developed a tabular format for presenting R&M achievements during contractor trials and initial test and evaluation of the PHM.
- Prepared the DSARC III technical data supporting documentation required for the Logistic Support Plan Summary.
- Evaluated the planning status for transition from contractor support to organization support of data management, collection, updating, and retrieval.
- Developed a working schedule for submission of DCP supporting documentation.
- Identified planning and action deficiencies and responsible parties.

2.16.2 Submittals

- Summary Letter Report, "Integrated Logistic Support Planning/Action Status", 28 July 1975
- Summary Letter Report, "ILS Planning Deficiency Correction Schedule and Milestone Chart", 21 October 1975
- Summary Letter Report, "Configuration Management Design/Engineering Change Control", 14 November 1975
- Summary Letter Report, "Requisition Procedures/Material Flow and Operations and Maintenance Data System for the PHM-1 Interim Support Period", 9 September 1975
- Summary Letter Report, "Maintenance Support Program", 9 September 1975
- Summary Letter Report, "Logistic Technical Data Program", 9 September 1975
- Summary Letter Report, "Decision Coordinating Paper Planning/Action Status", 9 September 1975
- Publication 1616-16-7-1466, "Final Summary Report — NATO PHM Ship Acquisition Project DSARC III ILS Review and DEP Development Planning", December 1975

2.17 TASK 17: DEVELOP SPECIFICATION PACKAGE FOR PROCUREMENT OF AMCM RECOVERY SYSTEM

2.17.1 Activities

- Reviewed MIL-STD-490 referenced documents to add/delete special procurement package requirements.
- Developed inputs for the fabrication specification.
- Prepared detail drawings for AMCM Recovery System.
- Developed an Operational Logistic Support Plan for AMCM Recovery System.

2.17.2 Submittals

- Letter Report, "Fabrication Specification Requirements", 27 August 1975
- Letter Report, "Detail Drawing List for AMCM Recovery System", 27 August 1975
- Letter Report, "Operational Logistic Support Plan for AMCM Recovery System", 29 September 1975

2.18 TASK 18: RELIABILITY AND MAINTAINABILITY ENGINEERING SUPPORT ON MOBILE SUBMARINE SIMULATOR (MOSS) PROGRAM

2.18.1 Activities

- Assessed MOSS system reliability by collecting, reviewing, and evaluating all laboratory test data, sea run operational data, and failure reports. Failure histories were summarized, trends identified, and corrective-action recommendations derived.
- Assisted NOSC during investigations in the following specific areas:
 - a. Burn-in procedures
 - b. Previous problems and their corrective actions
 - c. Comparison of TECHEVAL and OPEVAL hardware
 - d. STM design review.
- Collected and evaluated quantitative maintainability data. All IMA preparation, maintenance, test and checkout operations performed on selected MOSS vehicles, launchers, and fire control panels were monitored. Data on the times and resources required (i.e., personnel, test equipment, etc.) to perform those operations were collected and analyzed as to their adequacy for establishing MOSS system readiness.
- Assessed MOSS system reliability and maintainability by collecting, reviewing, and evaluating all laboratory test data, sea run operational data, and failure reports. Failure histories were summarized, trends identified, and corrective action recommendations submitted. In addition, assistance was provided to NOSC in the following specific areas:
 - a. Prepared/reviewed a Reliability Improvement Program Plan
 - b. Prepared R&M data for monthly progress reports
 - c. Attended weekly MOSS meetings, design reviews, and other scheduled program planning conferences
 - d. Prepared and reviewed OPEVAL test plans/procedures.

2.18.2 Submittals

- Publication 1616-18-8-1485, "Reliability and Maintainability Assessment of Mobile Submarine Simulator During Technical Evaluation", March 1975

- Letter Report FSP-75-157, "Updated MOSS Reliability Information", 5 September 1975
- Letter Report FSP-75-184, "Maintainability Assessment of Mobile Submarine Simulator from TECHEVAL Data", (Interim), 24 September 1975
- Final Letter Report CA/W 76-055, 11 March 1976.

2.19 TASK 19: ASSIST IN DEVELOPMENT OF RELIABILITY, MAINTAINABILITY AND AVAILABILITY TEST METHODOLOGY FOR SOSUS UPDATE OPEVAL

2.19.1 Activities

- Reviewed SOSUS Update RM&A requirements and the actual RM&A conditions at the Centerville facility. This review was for the purpose of establishing test objectives and methodologies for the SOSUS Update OPEVAL.
- Reviewed SOSUS Update development tests to ascertain the extent of RM&A information availability.
- Developed basic test objectives, methodology and constraints for the RM&A elements of the OPEVAL.
- Established guidelines for the acquisition of RM&A data during OPEVAL.

2.19.2 Submittal

- Letter Report CA/E-76-178, "An Approach to RM&A Evaluation of the SOSUS Backfit System OPEVAL", 11 March 1976

2.20 TASK 20: CONDUCT RELIABILITY AND MAINTAINABILITY ENGINEERING SUPPORT ACTIVITIES ON MOSS PROGRAM

2.20.1 Activities

- Participated in design reviews and program status meetings.
- Performed OPEVAL planning and prepared R&M forms/data package for use during OPEVAL.
- Prepared monthly OPEVAL progress reports.

- Provided assistance in production planning. Prepared revisions to and updated the R&M section of an Advanced Procurement Plan by:
 - a. Determining estimated costs for all program elements, and refining the acceptance test and proofing incentive structure.
 - b. Defining specific preproduction and periodic test requirements, and reliability demonstration test requirements.
 - c. Developing a Weapon Specification (WS) describing in detail the R&M assurance requirements to be imposed upon the production contractor.
 - d. Defining the technical risks and criticality of requirements.
- Provided on-site OPEVAL support at AUTEC. During the OPEVAL period, all tests and their results were monitored; failure reports were prepared, analyzed, and resolved; and recommendations were submitted for run evaluations. Assistance was provided to Fleet, NTS, and OPTEVFOR personnel in the data collection and analysis effort.
- Reviewed the MOSS system design documentation package to ensure its adequacy for competitive production procurement by investigating drawing and specification adequacy and conformance to Mil-Std requirements. . Ensured that correct part identification and traceability exists between the various types of documentation (i.e., schematics, assembly drawings, parts lists, wiring diagrams, specifications, etc.). Included in this effort were the preparation of a non-standard parts list and a review of parts qualification data. The extent of subcontractor control was investigated, as well as areas where existing prime contractor proprietary techniques, tooling, and/or procedures affect a competitive bid.

2.20.2 Submittals

Submittals under Task 20 are listed in Table 1.

2.21 TASK 21: PREPARE PROGRAM PLAN AND PROVIDE ENGINEERING SUPPORT FOR DEVELOPMENT OF FUTURE NAVAL SHIPBOARD COMMUNICATION TERMINALS

2.21.1 Activities

- Prepared a Program Plan that included the following items:
 - a. Program objectives
 - b. Description of the development approach

TABLE 1. SUBMITTALS UNDER TASK 20

Document No. and Date	Title
FSP 76-08 1/13/76	MOSS R&M Production Planning Data
FSP 76-097 5/26/76	MOSS Production Contract Bid Criteria
F76-500 thru -513 6/4/76 - 10/11/76	Electrical Component Failure Analysis Report
FSP 76-111 7/2/76	Comments on MOSS Program Documentation 1) Maintenance Engineering Analysis, dated 6/4/76 2) Preliminary Procurement Request (PR), dated 6/25/76
FSP 76-113 7/6/76	MOSS I/O Assembly, Drawing Documentation Review
Informal 11/11/76	Comments on Procurement Request (2nd Version)
FSP 77-011 1/31/77	Component Drawing Documentation Review
Publication 1616-20-9-1575 1/31/77	Reliability and Maintainability Assessment of Mobile Submarine Simulator During Operational Evaluation (U), CONFIDENTIAL
FSP 77-014 2/14/77	MOSS Production Acceptance Criteria
FSP 77-055 4/29/77	Comments on MOSS Program Documentation 1) Proofing Specification OPEVAL Defect Summary (Vehicle Only), dated 3/11/77 2) Procurement Request (3rd Version), dated 4/7/77
FSP 77-060 5/13/77	MOSS Production Data System Study (U), CONFIDENTIAL

- c. Program management description
 - d. Definition of program schedules and related milestones
 - e. Financial requirements and cost control techniques
 - f. Work breakdown structure
- Investigated the applicability of the military specifications and standards that must be considered during development of a shipboard communication terminal.
 - Determined the requirements for a shipboard communication terminal integration guidelines document.
 - Developed a detailed outline of the integration guidelines document.

2.21.2 Submittals

- "A Quick Look at the Defense System Acquisition Review Council (DSARC)", November 1976 (informal submission)
- "Data Link Development Program Plan", December 1976 (informal submission)
- "Program Plan for Development of Future Naval Shipboard Communications Terminals", January 1977 (informal submission)
- "Minutes of JTIDS Technical Meetings at NOSC" (submitted weekly during contract period)
- Final Letter Report CA/W-77-202, 30 June 1977

2.22 TASK 22: PROVIDE EFFECTIVENESS ASSURANCE ENGINEERING SUPPORT FOR MINE NEUTRALIZATION VEHICLE SYSTEM (MNV) PROGRAM

2.22.1 Activities

- Assisted NOSC in developing a Project Master Plan (PMP) for the MNV System. Inputs for the PMP concentrated on the system effectiveness elements of the plan as set forth in NAVMATINST 5200.11B. A planning philosophy was developed for the areas of reliability, maintainability, ILS, personnel and training, test and evaluation, environmental factors, and integration, among others. Tradeoff information was developed to support the decisions resulting from the philosophy presented.

- Developed preliminary effectiveness assurance provisions for the Engineering Development Model (EDM) specification. Cost/risk tradeoffs were performed for all elements of the system, considering various levels of Mil-Spec compliance. The resultant assurance provisions included reliability and maintainability in accordance (as applicable) with NAVSEAINST 3900.2 of 2 September 1975, in addition to the assurance elements required by NAVMATINST 5200.11B for consideration.
- Developed a draft procurement specification package for the MNV Engineering Development Model. This package contained the following elements:
 - a. Draft system specification
 - b. Proposal evaluation criteria
 - c. CDRL

2.22.2 Submittals

- "Draft Project Master Plan (PMP) November 1976 (informal submission)
- "Prime Item Product Function Specification for Mine Neutralization Vehicle (MNV) System Engineering Development Model (EDM)", 20 January 1977
- "Draft Procurement Package", March 1977 (informal submission)
- Final Letter Report FSP-77-029, 15 March 1977

2.23 TASK 23: PROVIDE PRODUCT SPECIFICATION EFFECTIVENESS ASSURANCE REQUIREMENTS FOR MINE NEUTRALIZATION VEHICLE (MNV) SYSTEM

2.23.1 Activities

- Finalized the MNV Engineering Development Model (EDM) Specification Effectiveness Assurance Requirements by assessing and integrating NAVSEA review comments into the preliminary MNV EDM Specification.
- Monitored, documented and analyzed the MNV Advanced Development Model (ADM) Deep Ocean Tests, and prepared changes to the EDM Specification as a result of Deep Test results.

2.23.2 Submittals

- "Prime Item Development Specification for Locator Mk 21 Mod 0", 1 March 1977 (informal submission)
- Final Letter Report FSP-77-143, 30 September 1977

2.24 TASK 24: PROVIDE ANALYSIS OF RELIABILITY OF GEARS FOR AN/BQS-15
PEDESTAL

2.24.1 Activity

- Conducted a detailed assessment of the ability of drive gears to meet a required design goal life.

2.24.2 Submittal

- Letter Report FSP-77-024, "Evaluation of the Analysis for Determination of Suitability of Gears as a Drive Mechanism for the AN/BQS-15 Pedestal", 28 February 1977

2.25 TASK 25: PROVIDE RELIABILITY AND MAINTAINABILITY SUPPORT ON
JOINT TACTICAL INFORMATION DISTRIBUTION SYSTEM (JTIDS) SHIPBOARD
PROGRAM

2.25.1 Activities

- Investigated the operational utility of several alternate possibilities for the application of JTIDS to the AEGIS Shipboard Program. Obtained the quantitative data necessary for defining the most promising application to AEGIS.
- Prepared descriptive materials suitable for explaining the JTIDS application alternatives to offices in CNO and at the Naval Systems Commands. Assisted NOSC in preparing and carrying out the meetings for presenting the information at CNO, the Systems Commands, and at preliminary meetings with AEGIS personnel.
- Assisted NOSC in determining potential shipboard electromagnetic environment problems between JTIDS and other shipboard systems; provided an initial analysis of the problem areas; and defined requirements for test programs to aid in problem solution.

2.25.2 Submittals

- Letter FSP-77-147, "Draft Bench Test Plan", 5 August 1977
- Discussion paper on the benefits to AEGIS offered by high capacity CNI systems (informal submission)
- Final Letter Report

2.26 TASK 26: PROVIDE SUPPORT IN DEVELOPMENT OF NOSC RELIABILITY AND MAINTAINABILITY POLICY DOCUMENT

2.26.1 Activities

- Developed inputs for a preliminary reliability and maintainability (R&M) policy document for NOSC. Current Navy R&M policy and requirements were reviewed and translated into the policy document.
- Compared the requirements set forth in Department of Defense Directive 5000.X (Draft), Reliability and Maintainability (R&M) of System and Equipment, to existing Navy R&M policy and provided NOSC with an impact assessment.

2.26.2 Submittals

- Letter FSP-77-085, "Reliability and Maintainability Policy Report", 11 July 1977
- Letter FSP-78-028, "NOSC Reliability Implementation Manual", 31 January 1978

2.27 TASK 27: SHIPS TOWED ACOUSTIC DECEPTION DEVICE (STADD) SYSTEM EFFECTIVENESS SUPPORT

2.27.1 Activities

- Established quantitative requirements for and reported on system reliability and maintainability during system testing.
- Developed detailed maintainability demonstration test procedures.
- Monitored and reported on the maintainability demonstration test.

2.27.2 Submittals

- "An Evaluation of STADD Reliability Requirements", June 1977 (informal submission)
- "Maintainability Demonstration Test Plan and Procedure for Countermeasures Set AN/SLQ-33 (STADD)", November 1977
- "Interim Maintainability Demonstration Test Report for the Countermeasures Set AN/SLQ-33 (STADD)", 16 December 1977
- Final Letter Report FSP-78-022, 31 January 1978

2.28 TASK 28: PROVIDE RELIABILITY AND MAINTAINABILITY ENGINEERING SUPPORT ON MOBILE SUBMARINE SIMULATOR (MOSS) PROGRAM

2.28.1 Activities

- Reviewed a proposal from NTS/Keyport covering the data system and procedures to be utilized in MOSS production, proofing, and Fleet utilization.
- Collected and evaluated MOSS sea run and failure data accumulated since OPEVAL.
- Reviewed the QA program plan and associated R&M documentation of the production contractor (Gould, Inc.)

2.28.2 Submittals

- Letter FSP-77-068, "MOSS Production Data System — Review Comments on NTS/Keyport Proposal for PARR System", 31 May 1977
- Letter FSP-77-073, "Comments on Gould, Inc. Recommendations Concerning Procurement Request R&M Provisions", 17 June 1977
- Final Letter Report FSP-77-073, 17 June 1977

2.29 TASK 29: PROVIDE SYSTEM EFFECTIVENESS ENGINEERING SUPPORT FOR STADD PROGRAM

2.29.1 Activities

- Developed TECHEVAL procedures and provided TECHEVAL analysis support.
- Reviewed the STADD configuration baseline.
- Conducted a study of the potential STADD production cost.
- Conducted a logistics study to determine requirements and cost estimates for STADD intermediate and depot level maintenance.

2.29.2 Submittals

- Letter FSP-77-113, "Discussion of Errors in the NOSC Acoustic Source Level Calculation (ACSOL) Program Due to the Lloyd Mirror Effect", 6 September 1977

- "Technical Evaluation (TECHEVAL) Test Plan for the AN/SLQ-33 Ship Towed Acoustic Deception Device (STADD)", September 1977 (informal submission)
- "Reliability Evaluation Procedures for the Countermeasures Set AN/SLQ-33 (STADD)", Revision 1, December 1977 (informal submission)
- "Reliability Evaluation Report for the Acoustic Countermeasures Set AN/SLQ-33 (STADD)", December 1977 (informal submission)
- "Configuration Baseline Review for the Engineering Development Model of the Countermeasures Set AN/SLQ-33 (STADD)", January 1978 (informal submission)
- "Logistic Support Cost Study for the Countermeasures Set AN/SLQ-33 (STADD)", January 1978 (informal submission)
- Letter FSP-78-044, "Production Cost Estimate for the Countermeasures Set AN/SLQ-33 (STADD)", 13 February 1978
- Final Letter Report FSP-78-023, 31 January 1978

2.30 TASK 30: PROVIDE ENGINEERING SUPPORT TO FLEET RELIABILITY ASSESSMENT PROGRAM

2.30.1 Activities

- Reviewed contractors' deliverable reliability data on the following programs:
 - a. AN/UYK-20 Data Processing Set
 - b. AN SYQ-7(V)2 Naval Modular Automated Communications System (NAVMACS A+).

2.30.2 Submittals

- Letter FSP-77-141, "AN/UYK-20 Reliability Failure Summary", 7 October 1977
- Letter FSP-78-030, "Fleet Reliability Assessment Program (FRAP) Phase II Data Collection Plan for AN/SYQ-7(V)2 (NAVMACS A+)", 31 January 1978
- Final Letter Report FSP-78-030, 31 January 1978

2.31 TASK 31: REVIEW VARIOUS QUALITY ASSURANCE AND INTEGRATED LOGISTIC SUPPORT CONTRACT DELIVERABLE DATA ITEMS

2.31.1 Activities

- Reviewed the preliminary failure modes and effects analysis for the ESM Expansion/ELINT Add-on System.
- Reviewed and commented on the K-A non-standard parts requests.
- Developed the SCIACT System Quality Program Plan.
- Developed the SCIACT System Safety Program Plan.
- Reviewed and commented on ESM Expansion/ELINT Add-on System reliability prediction.
- Reviewed and commented on the High Band Pass Receiver reliability prediction.

2.31.2 Submittals

- Letter FSP-77-140, "Preliminary Failure Mode and Effect Analysis for ESM Expansion/ELINT Add-on System; Review Comments", 7 October 1977
- "Comments on K-A Non-Standard Parts Requests", November 1977 (informal submission)
- "SCIACT System Safety Program Plan", January 1978 (informal submission)
- "SCIACT System Quality Program Plan", January 1978 (informal submission)
- Letter FSP-78-033, "Comments on ESM Expansion/ELINT Add-on System Reliability Prediction", 6 February 1978
- Letter FSP-78-032, "Comments on High Band Receiver Final Reliability Prediction", 6 February 1978

2.32 TASK 32: PROVIDE SYSTEM EFFECTIVENESS SUPPORT ON THE OFFBOARD DECOY DEVICE SYSTEM (ODDS) PROGRAM

2.32.1 Activities

- Developed a preliminary draft system specification for ODDS.
 - Developed a preliminary system effectiveness program plan.
- 30

2.32.2 Submittals

- "Preliminary Draft, System Specification for the ODDS", January 1978 (Informal submission)
- "Preliminary Draft, ODDS Program Plan", January 1978 (Informal submission)
- Final Letter Report FSP-78-036, 31 January 1978

2.33 TASK 33: PROVIDE SYSTEM EFFECTIVENESS SUPPORT DURING MINE NEUTRALIZATION VEHICLE (MNV) SYSTEM PROPOSAL EVALUATION

2.33.1 Activities

- Assessed the system effectiveness elements of five MNV proposals and provided NOSC with recommendations relative to the acceptability of the proposed approaches.
 - a. Assisted in the development of proposal clarification questions.
 - b. Consulted with NOSC/NAVSEA evaluation team in the numerical scoring of proposed system effectiveness elements, i.e., reliability, maintainability, safety, ILS, etc.
 - c. Assisted in the development of risk (Navy) statements resulting from the initial proposal evaluation phase.
 - d. Assisted NOSC Code 2512 in the initiation of narrative proposal-evaluation reports.

2.33.2 Submittals

- Draft proposal evaluation reports (Informal submissions)
- Final Letter Report FSP-78-035, 31 January 1978

2.34 TASK 34: PROVIDE MINE NEUTRALIZATION VEHICLE (MNV) SYSTEM/ MINE COUNTERMEASURES (MCM) INTEGRATION SUPPORT

2.34.1 Activities

- Developed initial manpower/skill level estimates for MNV operations aboard the MCM ship.
- Provided assistance in the development of the MNV/MCM interface package.

2.34.2 Submittals

- Letter FSP-77-063, "Mine Neutralization Vehicle (MNV)/Mine Counter-measures Ship (MCM) Manpower Integration Considerations", 8 November 1977
- Final Letter Report FSP 78-038, 31 January 1978

2.35 TASK 35: PROVIDE SYSTEM EFFECTIVENESS SUPPORT FOR NOSC JTIDS SHIPBOARD TERMINAL PROGRAM

2.35.1 Activities

- Identified existing documentation and related descriptive information on the JTIDS terminal that serves as the data base for the specification. This information was obtained from JPO and NOSC personnel, and from current industrial developers of the JTIDS terminals. The following areas were considered:
 - a. Compatibility with the Phase I JTIDS terminal
 - b. Performance in functional areas such as relative navigation, IFF, TACAN, Link 11, Link -4, digital data, digital voice, and relay
 - c. Basic architecture (e.g., DTMA, Growth TDMA, etc.)
 - d. Interference, such as EMI and jamming
 - e. Reliability and maintainability
 - f. Hardware considerations such as LRU configuration, materials, BITE, and others
 - g. Electrical characteristics such as operating power, overload protection, and voltage transients
 - h. Interfaces for antenna, platform, and operator
 - i. Design requirements for ship type/class variation (e.g., CV terminal, FFG terminal, shore terminal, etc.)
 - j. Unique requirements such as LPI, security, and net management control systems
 - k. Quality assurance provisions, packaging, and contractual conditions
- Analyzed the information from the above activity and identified a preliminary outline for recommendations for the specification. Prepared the outline describing what each section, subsection, etc., should contain, and what information is needed for the specification.

- Documented evaluation of draft specification outline and identified critical items for further investigation.

2.35.2 Submittals

- Publication W78-1616-TN01, "Outline for the Phase II Joint Tactical Information Distribution System (JTIDS) Shipboard Terminal Specification", January 1978
- Final Letter Report CA/W 78-037, 8 February 1978

APPENDIX A

CONTRACT TASK DESCRIPTION

Under Contract N00123-73-C-1698, ARINC Research Corporation provided reliability, maintainability, design, and quality assurance studies on various Navy Ocean Technology projects in accordance with ARINC Research Proposal W149, dated January 1973.

Work to be performed under the subject contract was to include, but not be limited to, the following task areas:

1. System and component engineering tasks, including:
 - 1.1 Vendor surveys and liaison
 - 1.2 Contractor and project technical data and documentation review
 - 1.3 Microelectronics capability development
 - 1.4 Reliability specification development and review
 - 1.5 System functional definition
 - 1.6 Design and prototype development of electronic systems and components, including fabrication of monolithic integrated circuits and hybrid microcircuits in engineering sample quantities
 - 1.7 Mechanical and electronic design for reliability and maintainability improvement
 - 1.8 Effectiveness and test program planning
2. System and component analysis and evaluation tasks, including:
 - 2.1 Reliability and maintainability tradeoff analysis
 - 2.2 Component selection and application analysis
 - 2.3 Microelectronic reliability testing and evaluation
 - 2.4 Integrated circuit analysis and application
 - 2.5 Circuit evaluation
 - 2.6 Analysis and interpretation of field data on system and component performance, reliability, and maintainability
 - 2.7 Reliability and maintainability data bank operations
 - 2.8 Detailed part failure analysis

- 2.9 Vendor reliability and quality assurance surveys
 - 2.10 Test surveillance and evaluation
 - 2.11 Reliability and maintainability design review, analysis, and evaluation
 - 2.12 Reliability prediction and allocation
 - 2.13 Safety analysis and evaluation
 - 2.14 Failure mode and effects analysis (FMEA)
 - 2.15 Structural/mechanical analysis
 - 2.16 Worst-case mechanical tolerance analysis
- 3. Consulting services on reliability, maintainability and safety, including program planning, cost studies, and contractor surveillance.
 - 4. Training of personnel in reliability, maintainability, safety, and cost effectiveness techniques through day-to-day contacts and formal training, including curriculum development, technical instruction, training manuals, visual aids, and technical consultation on training films.
 - 5. Documentation development, including formal and informal reports and presentations.
 - 6. Development of failure reporting and failure recurrence control systems.